



Learning Objective

To use spatial visualisation and logical reasoning to solve problems

Materials:

cubes such as wooden, Multilink™ or Unifix™ cubes

Focus

These activities explore arrangements and dissections of three-dimensional figures in order to determine how particular outcomes are formed. Spatial as well as logical thinking and organisation are involved as students investigate all likely arrangements to ensure that the final forms match the given criteria or visualise a given figure in terms of its component parts.

Possible difficulties

- Unable to visualise the cubes in the representations on the two-dimensional page
- Only considers the cubes that can be readily seen on the outside of the figures

Extension

- Have students make stacks using different arrangements of cubes and others work out how many were used.
- Use isometric paper to draw the stacks they make and have other students see how many cubes are used.
- Extend the problems by asking what would happen if more blocks had been used – if each arm of the 'T' had one, two or more additional cubes before painting. What if the large block had been cut into cubes with sides of one centimetre? What if the cube was cut into 64 or 125 smaller cubes?

Teacher Notes for Activity 4



Learning Objective

To use strategic thinking to solve problems

Materials

0–99 number board

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Focus

This activity explores students' understanding of the number system and their ability to solve questions about numbers. Students need to coordinate the reading and writing of numerals with the symbols involved in writing the numbers 400–600.

Possible difficulties

- Unable to keep track of the number of times they determine a digit or word
- Confusion between saying and writing the digits
- Not understanding that we say 'four' in numbers that contain 'forty', even though it is written differently as 'four' or 'fourteen'
- Thinking that 'five' is said for numbers with 'fifty'
- Confusion with 44, 55, etc. including only seeing the digit once when it actually occurs in both the ones and tens place

Extension

- Try other number ranges such as 300–500, 400–700, etc.
- Investigate the number of times 'five' is said and written when counting by fives or 25s.
- Make a table to display the results and present a description of the problems and their solutions to another class.



Learning Objective

To identify and use concepts about numeration

Materials

counters, blocks or a calculator

Focus

These activities explore solving problems involving number sense, magic squares and logic. Students need to carefully analyse the problems to locate information necessary to find the magic number or the arrangement of numbers. Counters, blocks or a calculator can be used to assist as these problems focus on the concepts of number sense and number logic rather than basic facts.

Possible difficulty

- Considering only rows or columns rather than rows, columns and diagonals in the magic squares or the smaller grids in the sudoku puzzles

Extension

- Investigate other magic squares and magic numbers.
- Explore sudoku games in magazines, newspapers and on the Internet that involve 4-by-4 grids as well as 9-by-9 grids. The geoshape koala sudoku pack available from educational suppliers provides a concrete way for children to enter sudoku puzzles.



Learning Objective

To analyse and use information in word problems

Materials

place value chart or a calculator

Focus

These activities explore word problems that mostly require addition or subtraction. Students need to determine what the problem is asking and, in many cases, calculate more than one step in order to find solutions. Analysis of the problems reveals that some questions contain additional information that is not needed.

If necessary, materials can be used to assist with the calculation as these problems are about reading for information and determining what the problem is asking rather than computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract or multiply
- Confusion over the need to carry out more than one step to arrive at a solution
- Using all the numbers listed in the problems rather than just the numbers needed

Extension

- Explore the possibilities as to whether the dry season would be before or after spring.
- Discuss how some problems can have more than one answer depending on different interpretations.
- Students could write their own problems and give them to others to solve.

Teacher Notes for Activity 11



Learning Objective

To solve problems involving money and make decisions based on particular criteria

Materials

counters, play money or a calculator

Focus

This activity explores reading for information, obtaining information from another source (the takeaway menu) and using it to find solutions. The problems are about using money, making decisions based on money and comparing amounts of money, rather than adding or subtracting. Solutions can be obtained using materials and comparison of amounts. Counters, blocks, play money or a calculator can be used if needed.

Possible difficulties

- Unfamiliarity with the '\$' symbol
- Not taking into account that they may need two or more of some items

Extension

- In pairs, students write their own questions based on the takeaway menu and give them to other pairs to solve.



Learning Objective

To use strategic thinking to solve problems

Materials

counters in two different colours (1 of one colour, 17 of another colour)

Focus

These activities explore more complex problems in which the most difficult step is to find a way of coming to terms with the problem and what the question is asking. Using materials to explore the situation is one way in which this can be done. Another is to use a diagram to assist in thinking backwards or making trials and adjusting to find a solution that matches all of the conditions.

Possible difficulties

- Using only the 11 cars that Lucy passed to determine her starting position
- Not taking into consideration all the criteria for the serial numbers
- Considering only some aspects of the puzzle scrolls

Extension

- Students write their own car race problems based on the questions.
- Students could use a different context other than racing cars for their stories.
- Students write their own criteria for working out a serial number.
- Explore other shapes and how many triangles, squares or rectangles there are in them.



Learning Objective

To analyse and use information in word problems

Materials

base 10 materials, place value chart, calculator

Focus

These activities explore word questions that require addition, subtraction or multiplication. The wording has been kept fairly simple to help with the problem-solving process. Students need to determine what the problem is asking and in many cases carry out more than one step in order to find solutions. Materials can be used to assist with the calculation if necessary as these problems are about reading for information and determining what the problem is asking rather than computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract or multiply
- Confusion over the need to carry out more than one step to arrive at a solution
- Using all the numbers listed in the problems rather than just the numbers needed

Extension

- Students could write their own problems and give them to other students to solve.

Teacher Notes for Activity 18



Learning Objective

To use patterns and logical reasoning to determine numbers in a table

Materials

calculator

Focus

This activity explores ordering of numbers to discern patterns that allow larger numbers to be determined without laboriously writing or counting all of the numbers up to the point asked for. It also highlights the value of using factors and multiples when thinking about numbers.

Possible difficulties

- Thinking that writing out all of the numbers is the only way to be sure of a solution
- Only considering the ones place when searching for a pattern
- Unable to verbalise a mathematical description of how the numbers are placed

Extension

- Describe a pattern for the row where a number occurs in the second arrangement.



Learning Objective

To read, interpret and analyse information

Materials

calculator, number expander

Focus

The activities explore concepts of place value and number sense. The relationships among numbers and place value are analysed and students are encouraged to not only find numbers that are possible but also to disregard numbers that are not possible. Place value and number sense are needed rather than addition or multiplication.

Possible difficulties

- Poor understanding of place value
- Wanting to add, subtract or multiply rather than using place value or number sense
- Not considering all of the criteria

Extension

- Students could write other problems involving the ice cream cones.
- Students could think up their own calculator problems and write the criteria to match.
- Work out the different possibilities for two children to have three boxes, each with totals of 11, 13, 14, 15, 16 and 17.



Learning Objective

To interpret and organise information found in a series of interrelated statements and to use logical thinking to find solutions

Focus

These activities explore interrelated statements within a problem situation that include concepts of averages, distance and payments. Students need to read the stories carefully in order to take into consideration a number of different criteria. Tables and lists can be used to help manage the various criteria.

Possible difficulties

- Not using a table or list to manage the data
- Not understanding the term 'average'
- Confusion when dealing with approximate times and distances

Extension

- Construct a table to show the running distance and how it varies from month to month.
- Write other problems using the same form of complex reasoning for other students to solve.

Teacher Notes for Activity 25



Learning Objective

To solve problems involving time and make decisions based on particular criteria

Materials

conversion table from 12-hour to 24-hour times, clock

Focus

This activity explores reading for information, obtaining information from a number of sources (information about the plane, the timetable and the shuttle bus) and using it to find solutions. The problems involve thinking about and working with time. Decisions are about being too early or too late rather than an exact time.

Possible difficulties

- Unfamiliarity with a timetable
- Confusion with 24-hour time
- Thinking that an exact flight is needed rather than flights that fit within the time frame

Extension

- Use the information and timetable with other criteria; for example, if you need to be in Cairns for a lunchtime meeting, what flights can you take?



Learning Objective

To use spatial visualisation and measurement to solve problems

Materials

paper to make and fold squares and equilateral triangles, triangle and square grid paper

Focus

These activities explore ideas of perimeter by using their knowledge of squares and equilateral triangles to visualise shapes and to determine the lengths of sides within or composed of the shapes. Spatial and logical thinking, as well as numerical reasoning and organisation, are involved as students investigate the relationships among the shapes to determine the required distances.

Possible difficulties

- Uncertain of definition of perimeter
- Not understanding that the sides of a square or equilateral triangle are of equal length
- Unable to visualise the sides of the smaller shapes within the large shapes
- Cannot keep track of the number of sides that need to be used

Extension

- Have students investigate shapes made from small equilateral triangles in the same way as those made from small squares.
- Ask students to create their own examples of perimeters in squares where the square is folded into 5, 6 or more rectangles.



Learning Objective

To analyse and use information in word problems

Materials

paper to fold

Focus

These activities explore word problems that require addition, subtraction, multiplication and an understanding of place value. The wording is more complex than in the previous problems that involved a combination of the three operations. Students need to determine what the problem is asking and, in many cases, carry out more than one equation in order to find solutions. Materials can be used to assist with the calculation if necessary, as these problems are about reading for information and determining what the problem is asking rather than computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract or multiply
- Not using place value concepts to solve the problems
- Confusion over the need to carry out more than one step to arrive at a solution
- Not understanding the concept of 'capacity'

Extension

- Students could write their own problems and give them to other students to solve.



Learning Objective

To read, interpret and analyse information

Materials

calculator, number expander

Focus

Students explore concepts of place value and number sense. The relationships among numbers and place value are analysed and students are encouraged to find suitable numbers and disregard numbers that are not possible. Place value and number sense are needed rather than division.

Possible difficulties

- Not considering place value to solve the questions
- Not taking into consideration the starting page of each chapter

Extension

- Change the criteria involving the number of pages in the book and the page number read to explore the problems again based on the new criteria.



Learning Objective

To use spatial visualisation, logical reasoning and measurement to solve problems

Materials

paper to fold

Focus

These activities explore different ways of visualising problems and analysing the possibilities that make up the whole solution. Logical reasoning is required, as well as an understanding of measurement (kilometres, metres and centimetres). In each situation, diagrams can be used to organise, sort and explore the data.

Possible difficulties

- Unable to convert centimetres to metres or metres to kilometres
- Not using the given data to determine the sides whose length is not stated
- Unable to see how the information in the problems can balance
- Unsure of the area of a square and confusing it with perimeter

Extension

- Students could write their own problems involving distance around an irregular shape where some of the lengths have to be worked out from the information in the diagrams. Other problems could involve items on a balance or areas cut from inside an arrangement of shapes. The problems are then given to other students to solve.



Learning Objective

To solve problems involving time or coordinates and to make decisions based on particular criteria

Materials

digital clock, 0–99 number board

Focus

These activities focus on reading for information, obtaining information from a number of sources and using it to find solutions. The problems involve thinking and working with time and coordinates. Decisions based on times being earliest or latest are needed as well as exact time.

Extension

- Use the information and timetable to write other questions.
- Construct a similar timetable for two pizza shops where one opens for lunch and dinner while the other opens just for dinner.
- Have students call out the coordinates they have drawn to other students to construct paths and compare results.



Learning Objective

To use strategic thinking to solve problems

Materials

counters

Focus

These activities explore problems that may have several answers and further analysis of the connections among the data is needed to see whether this is the case or whether there is only one solution. A process of 'try and adjust' could be used; however, using logical reasoning to think about possibilities and using a table, diagram or materials to organise them will be more productive. These ways of thinking can then be used to solve other complex problems.

Possible difficulties

- Not using a table or diagram to manage the data
- Not considering all the possible answers – there may be more than one possibility
- Only keeping one condition in mind when there are two aspects to consider and reconcile

Extension

- Discuss the various methods used by students to solve the problem. Include the ones discussed above. Ask them to solve each problem using a different method from the one they used or first tried. Encourage them to use a diagram rather than simply calculate.

Teacher Notes for Activity 42



Learning Objective

To use logical reasoning and spatial visualisation to solve problems

Materials

counters, base 10 materials

Focus

This activity explores problems based on a conceptual understanding of fractions. Writing the fractions using numbers and words is designed to help students focus on the number of parts as well as their comparative sizes and to lead them to consider other ways of solving the problems other than by fraction calculations. One way of solving them is by backtracking from the answers. Counters can be useful as they allow the parts to be considered while the whole problem is also being kept in mind. Using a diagram is another method and is probably a different way of thinking about fractions from is used by many students and teachers.

Possible difficulties

- Not confident working with fractions
- Thinking that 1 third and 1 half gives 1 fifth
- Thinking that 2 thirds of Peter's initial money, together with 1 third of what is left, must account for all of his money
- Not being able to consider using materials or a diagram and attempting a solution on the basis of calculations

Extension

- Change the fraction amounts, but leave the problem statements the same.
- Change the problem contexts, but leave the fraction amounts the same.
- Have students make up problems of their own and challenge others to solve them using diagrams.



Learning Objective

To analyse and calculate information in word problems

Materials

base 10 materials, place value chart or a calculator

Focus

The activities explore word problems that mostly require addition or subtraction. Students need to determine what the problem is asking and, in many cases, carry out more than one calculation in order to find a solution. Analysis of the problems reveals that some problems contain additional information that is not needed. Materials can, if necessary, be used to assist with the calculation as these problems are about reading for information and determining what the problem is asking rather than computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract or multiply
- Confusion over the need to carry out more than one step to arrive at a solution
- Using all of the numbers listed in the problems rather than just the numbers needed
- Difficulty with the concept of profit

Extension

- Discuss how problems can have more than one answer depending on different interpretations.
- Students could write their own problems and give them to other students to solve.
- Explore how many of these problems could be solved using the repeated addition technique on the calculator; i.e. enter $273 + 273$ and then hit the 'equal' key – keep hitting the key and you will keep adding 273 without having to continue entering the same number.

Teacher Notes for Activity 46



Learning Objective

To use logical reasoning and spatial visualisation to solve problems

Materials

counters, grid paper, calculator

Focus

This activity explores problems based on a conceptual understanding of height, along with an awareness that it is the initial position that is required, not the end point. One way of solving the problems is by backtracking from the answers. Using counters on a vertical grid or line can be useful as they allow the individual movements up and down to be considered while the intent of the problem is kept in mind. The use of diagram or calculator are other ways to manipulate the data in the order in which it needs to be used.

Possible difficulties

- Unable to use a diagram or materials to come to terms with the problems
- Not considering the movements relative to an initial position to obtain an appropriate starting point; e.g. thinking there are 52 rungs rather than 53
- Not realising that a ball will bounce both up and down before getting to its new level
- Simply working on the basis of calculations with the numbers in the problem to obtain incorrect answers

Extension

- Change the numbers in the problems, but leave the questions the same.
- Change the problems' contexts, but leave the numbers the same.
- Have students make up problems like these of their own and challenge others to solve them using diagrams or materials.



Learning Objective

To use strategic thinking to solve problems

Materials

counters in several different colours, coins

Focus

These activities explore other complex problems in which the most difficult step is to find a way of coming to terms with the problem and what each question is asking. Using materials to explore the situation is one way this can be done. Another is to use a diagram to assist in thinking backwards or trialling and adjusting to find a solution that matches all of the conditions.

Possible difficulties

- Considering only some aspects of the puzzle scrolls
- Not taking into consideration the remainders when considering multiples
- Not being able to keep track of the changes in the coins

Extension

- Write problems based on the puzzle scrolls.
- Provide other combinations of pictures and pages for the scrapbook problem.
- Extend the coin problems to start with larger numbers of coins and look for patterns.



Learning Objective

To analyse and use information in word problems

Materials

place value chart, calculator

Focus

These activities explore word problems that require a number of operations, including division. The wording has been kept fairly simple to help with the problem-solving process. Students need to determine what the problem is asking and in many cases carry out more than one equation in order to find solutions. If necessary, materials can be used to assist with the calculation as these problems are about reading for information and determining what the problem is asking rather than computation or basic facts.

Possible difficulties

- Inability to identify the need to add, subtract, multiply or divide
- Confusion over the need to carry out more than one calculation to arrive at a solution
- Using all of the numbers listed in the problems rather than just the numbers needed
- Not thinking in terms of the problem and writing solutions such as '763.3 bins'
- Difficulty with the concept of 'tonnes'

Extension

- Students could write their own problems and give them to other students to solve.

Teacher Notes for Activity 53



Learning Objective

To use patterns and logical reasoning to determine numbers in a table.

Materials

grid paper, calculator

Focus

This activity explores students' understanding of numbers in order to discern patterns that allow larger numbers to be determined without laboriously writing or counting all of the numbers up to the point asked for. It also highlights the value of using factors and multiples when thinking about numbers.

Possible difficulties

- Thinking that writing out all of the numbers is the only way to be sure of a solution
- Only considering the ones place for the pattern
- Unable to verbalise a mathematical description of how the numbers are placed in columns or where the prime numbers are found

Extension

- For Problems 1 and 2, describe a pattern for the row where a number occurs.
- Investigate the topic of prime numbers further.
- Find some background information about Eratosthenes and other Greek mathematicians who were interested in numbers, such as Pythagoras.



Learning Objective

To identify and use students' understanding of number

Materials

counters, blocks or a calculator

Focus

These activities explore problems involving number sense, magic squares and logic. Analysis of the problems to locate given information is necessary to find the magic number or the arrangement of numbers. Counters, blocks or a calculator can be used to assist as the focus of the problems is on the concepts of number sense and number logic rather than solving basic facts.

Possible difficulties

- Considering only rows or columns rather than rows, columns and diagonals

Extension

- Investigate other magic squares, magic numbers and magic shapes.
- Explore sudoku games in magazines, newspapers and on the Internet that involve 6-by-6 grids and 9-by-9 grids.
- Investigate the Geoshape™ Koala Sudoku pack available from educational suppliers.